Computer Lab 07

Objectives

- Add cost model
- Use of Statistics Module
- Using Process Analyzer (PAN)
- Evaluating Alternatives to select the "best"

Add Costs to Inventory Model

The basic model will be the Inventory model that is described in section 5-10 of the text (pp. 233-247). The problem is from Exercise 6-10 (p. 280 of text). Instead of the model built there, we will use one that is built using the Basic and Advanced Process modules. The basic model may be downloaded from the course web page (see below).

The data for the costs are given in the text and are summarized in Table 1 below.

Item	*Cost*
Order Cost	$32.00 per order placed
Unit Cost	$3.00 per unit ordered
Unit Holding Cost	$1.00 per unit per day
Unit Shortage Cost	$5.00 per unit short per day

Table 1. Costs for Inventory Model

Download the Inventory Model located on the course Handouts page (http://diana.gl.nps.navy.mil/gb4440/Handouts.html). Run the model to make sure that it is working correctly.

Next, add the costs to the model so that the average cost per day is computed for each run. Enter each of the values in Table 1 in the Variables module (in the Basic Process template).

To accumulate the total cost for placing the orders and for the units, first define a Variable called Total Order Cost, but don't give it a value. Add a line to the Place Order Assign module that assigns the Total Order Cost to the expression "Total Order Cost + Order Cost + Unit Cost * Order Amount". This adds the cost of the new order to the total ordering cost. Make sure this new line is the last one in the Assign module, or at least comes after the Order Quantity attribute is set.

To complete adding the costs to the model, go to the Statistic module in Advanced Processes and create three rows containing the data in Table 2 below..

Name	*Type*	*Expression*
Holding Cost	Time Persistent	Unit Holding Cost * MX(Inventory Position, 0)
Shortage Cost	Time Persistent	Unit Shortage Cost * MX(-Inventory Position, 0)
Avg Order Cost	Output	Total Order Cost / Run Length
Avg Total Cost	Output	OVALUE(Avg Order Cost) + DAVG(Holding Cost) + DAVG(Shortage Cost)

Table 2. Costs in the Statistic Module

Holding costs accumulate whenever inventory is being held, but not when there are backorders. Recall that "Inventory Position" is positive when there are units in stock, but negative when there are backorders. Therefore, the expression MX(Inventory Position, 0) gives the number of units in stock and the expression MX(-Inventory Position, 0) gives the number of units on backorder (shortage).

The functions shown in Table 2 are as follows. 'MX(a,b)' gives the maximum of the values a and b. Therefore, "MX(Inventory Position, 0)' evaluates to either the number if units in stock (if Inventory Position is positive) or 0 (if Inventory Position is negative).

OVALUE(*e*) gives the last value for the expression *e*. So at the end of each run, OVALUE(Avg Order Cost) returns the value of the average order cost at the end of the run.

DAVG(*e*) gives the time-persistent average of the expression *e*. Therefore, DAVG(Holding Cost) gives the time-persistent average of the holding costs, as determined by the expression Holding Cost.

Run your model with 50 replications. The total average cost should be around $125.00.

Use Process Analyzer to Make Multiple Runs

We will now evaluate the different combinations values of (s, S) from Exercise 6-10 using the Process Analyzer tool. Once your model is working properly, run the Process Analyzer (PAN) program. Then click File | New to create a new workspace. Save your project – it will create a ".pan" file. Save it as <your_name>_lab07.pan in the directory with your .doe model for lab 07.

The next step is to add the inventory scenario to the workspace. In the right pane, double-click to add a new scenario. PAN is looking for a ".p" file from an existing Arena model. Browse to your lab 07 directory and select <your_name>_lab07.p. Name the scenario "(20, 40)".

The values you will be changing are "little-s" (the Trigger Point variable in the model) and "big-S" (the Order Up To variable). PAN calls such variables "Controls". To add "Trigger Point" as a Control, click Insert | Control, then select "Trigger Point" from the dialog. Change the type from "Real" to "Integer." Add "Order Up To" in a similar manner.

The output measures are called "Responses" by PAN. The output measure for this model is Avg Total Cost. Click Insert | Response and select "Avg Total Cost" from the dialog. Your window should look something like Figure 1:

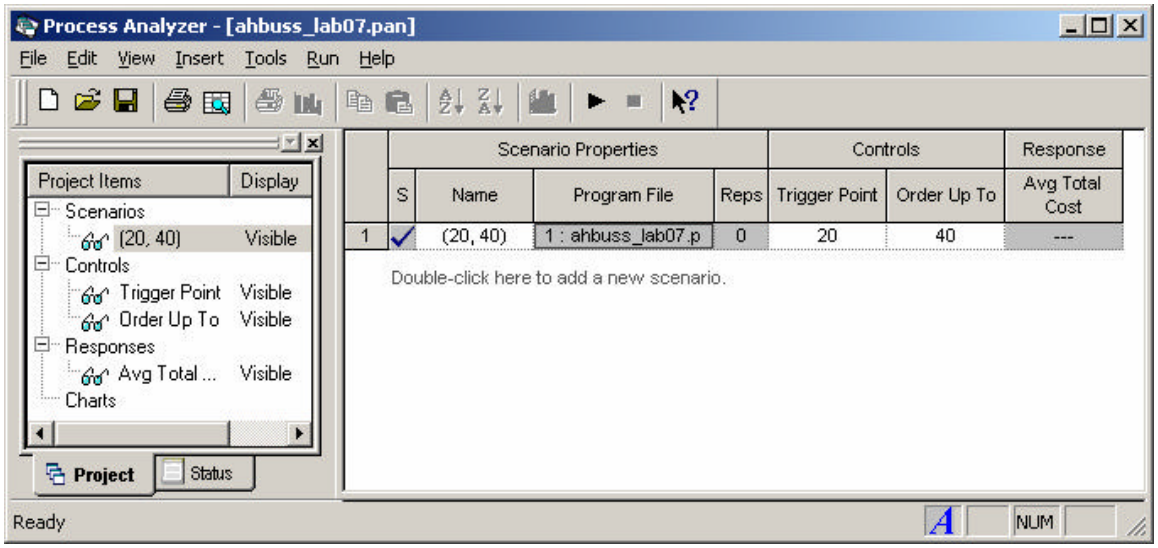

Figure 1. The PAN Window, after Adding a Scenario, Controls, and a Response

Click the VCR Play button to run your model from within PAN. The "response" should be identical to the overall average total cost in your run from within Arena.

Now add the additional 9 scenarios to the PAN workspace. PAN provides a convenient way to duplicate scenarios: click Edit | Duplicate Scenario from the menu, or press Ctrl-D. After doing this 9 times, you should have 10 identical scenarios. Now edit each one to match the additional 9 parameter combinations in Exercise 6-10. Name each scenario as the two values. So the scenario called "(40, 60)" will be the one where the trigger point is 40 and the order-up-to amount is 60.

Select all of the scenarios in the right pane and press the Play button. PAN will run each scenario in turn and save the results. This will take a few minutes.

The results in the Response column show that one combination indeed has the lowest total cost. The question is how confident we can be that it is indeed the lowest cost combination. This will be addressed in class next week.

Deliverables

Three files are needed to run this: the .doe and .p files from Arena and the .pan file from PAN. E-mail these three files. *Note:* Because of a virus thread, all .zip files are being deleted as attachments. Therefore, you have two options: (1) Attach the three files separately (to the same e-mail); (2) Change the name of your zip file from <your_name>_lab07.zip to <your_name>_lab07.jar before sending.[1]

[1] ".jar" files are identical in format to ".zip" files and can be opened using WinZip.